BEACH EROSION CONTROL REPORT ON COOPERATIVE STUDY OF WESSAGUSSETT BEACH WEYMOUTH, MASSACHUSETTS

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

APRIL 17, 1959

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

ADDRESS REPLY TO:
DIVISION ENGINEER

REFER TO FILE NO.

NEDGW

17 April 1959

SUBJECT: Beach Erosion Control Report on Cooperative Study of Wessagussett Beach, Weymouth, Massachusetts

TO: Chief of Engineers
Department of the Army
Washington, D. C.
ATTENTION: ENGWD

1. In accordance with Paragraphs 1-20 and 1-126, EM 1120-2-101, Chapter 1, Part CI, Engineering Manual for Civil Works Construction, ten (10) copies of the subject report, ten (10) copies of the letter of transmittal, three (3) reduced size display maps and three (3) copies of a draft of the public notice of issuance of the report, are submitted herewith. It is considered desirable that both Plates 1 and 2 be included in the printed report.

2. The Commonwealth of Massachusetts and the Town of Weymouth have considered the need of improvement of the Wessagussett Road section of the study area to be of sufficient importance to proceed with construction at this early stage of a smaller project. These agencies have applied for reimbursement for a share of the cost of this partial construction of the project recommended by the Division Engineer herein. They have been informed that reimbursement is dependent upon the will of Congress at the time of project authorization and appropriation of funds, and that to be eligible for reimbursement the project must be in conformance with that recommended by the Chief of Engineers after review by his staff and the Beach Erosion Board. Plans, specifications and contract papers for the construction, together with comments of the Division Engineer, are being submitted by separate letter for concurrent consideration.

3. Twelve (12) copies of the subject report, eleven (11) copies of the letter of transmittal, fourteen (14) extra copies of the reduced-size key drawings (Plates 1 and 2) and two (2) full-size prints of the report maps, are being forwarded this date direct to the Beach Erosion Board.

4 Incls:
1. Report (cy #1 inc; cys #2-10 u/s/c)
2. Transmittal ltr (10 cys)
3. Display Map (3 cys)
4. Draft of Public Notice (3 cys)

ALDEN K. SIBLEY
Brigadier General, U. S. Army
Division Engineer

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SUBJECT: Beach Erosion Control Report on Cooperative Study of Wessagussett Beach, Weymouth, Massachusetts

TO: Chief of Engineers, Department of the Army, Washington, D.C.

SYLLABUS

This study, made in cooperation with the Town of Weymouth, Massachusetts, includes an extent of about 3100 feet of shore, known as Wessagussett Beach, between the Wessagussett Yacht Club and the Fort Point Seawall. The purpose of the study is to determine the most suitable methods of shore protection, prevention of further erosion and improvement of beaches.

The Division Engineer recommends that the United States adopt projects authorizing Federal participation by the contribution of Federal funds in an amount equal to thirty-three percent of the first costs of construction of the following projects:

a. Wessagussett Road Section. - Sand Fill Plan. - Widening the beach as shown on Plate 2 by direct placement of about 45,000 cubic yards of suitable sand fill, construction of a stone groin, 375 feet long containing a drain pipe, tide gate and suitable navigation marker, and construction of three manholes.

b. Regatta Road and River Street Sections. - Sand Fill Plan. - Direct placement of about 140,000 cubic yards of suitable sand fill as shown on Plate 2, construction of a stone groin, 350 feet long and construction of a stone mound, 500 feet long.

The Division Engineer further recommends an alternative project for River Street Section if the Regatta Road and River Street Sections - Sand Fill Plan is not undertaken. This plan consists of a 500-foot stone mound or seawall. Federal participation for this project would be twenty-nine percent of the first cost.

The estimated amounts of Federal participation in the first costs of the recommended projects are $40,000 for the Wessagussett Road Section - Sand Fill Plan and $93,000 for the Regatta Road and River Street Sections - Sand Fill Plan, or $2,900 for the River Street Section - Alternative Stone Mound Plan.

BEACH EROSION CONTROL REPORT ON COOPERATIVE STUDY OF WESSAGUSSETT BEACH, WEYMOUTH, MASSACHUSETTS

I. GENERAL

1. Authority. - The study was made by the Corps of Engineers, United States Army, in cooperation with the Town of Weymouth, Massachusetts (acting through the Wessagussett Beach Development Committee) under authority of Section 2 of the River and Harbor Act approved July 3, 1930, as amended and supplemented. Formal application for the cooperative study dated January 6, 1958 was approved by the Chief of Engineers on March 3, 1958.

2. Purpose. - The purpose of the study, as stated in the formal application, is to determine the best method of restoration and stabilization of the beach and stabilization of the bluff between Wessagussett Yacht Club and the end of the existing seawall at the junction of River Road and Fort Point Road.

3. Prior Reports. - There have been no prior beach erosion control reports covering the study area. The latest report of Weymouth Fore River for navigation purposes was printed as House Document No. 555, 82nd Congress, 2nd Session and contains general information relative to the area. An unpublished report by the Wessagussett Beach Development Committee dated January 15, 1958 presents a plan of improvement for the area, summarized in Appendix E. The portion of the plan concerning the beach area is given consideration later in this report.

4. Weymouth Fore River Navigation Project. - Improvements of Weymouth Fore River for navigation purposes were first authorized in 1890 and extended in 1905, 1911, and 1916. The existing project was adopted in 1935 and was modified in 1940, 1945, and 1954, presently calling for a 300-foot wide channel, 30 feet deep, in the vicinity of the study area, with a widening at the bend of up to 650 feet. Improvement of that portion of the channel which lies opposite Wessagussett Beach dates back to 1911 when the bend in the channel was widened and rock was removed to 18 feet below mean low water. Later in 1918 and 1919 this portion of the channel was deepened to 24 feet and in 1936 and 1940 to 27 feet. Dredging operations were underway in December 1958 to deepen the channel to 30 feet.

5. Description. - Wessagussett Beach is located in the Town of Weymouth, County of Norfolk, Massachusetts. The problem area is near the mouth of Weymouth Fore River, east of its inland channel, along the south shore of Boston Harbor. The study area lies west of Fort Point, along the north shore of Great Hill in Weymouth and east of the Wessagussett Yacht Club. All shore frontage except for a 500-foot section along River Street, is owned by the town. A 400-foot section of the public shore is presently developed and used as a bathing beach and

includes the necessary bathhouse facilities. Pollution is reported by the Town Health Officer to be within the acceptable level. The area is well developed with predominantly all-year-round residences. The population of Weymouth in 1955 was 42,747 persons, and the populations of adjoining towns over 150,000 persons. The present population is estimated to be upwards of 50,000 persons. The nearest developed public beaches are Wollaston Beach, a Federal project in the City of Quincy, and Nantasket Beach in the Town of Hull.

6. Wessagussett Beach is accessible through a network of local narrow streets. The nearest State highway is Route 3A about 1/2 mile away. The area is shown on U.S.C. & G.S. Chart No. 246 and on the maps accompanying this report.

7. Statement of Problem and Improvements Desired. - The problem is basically one of general erosion due principally, as in most areas, to the advanced development of the shore and the erection of protective structures which have eliminated the sources for the supply of littoral material to the shore which formerly provided some equilibrium under natural shore processes. The area at the Wessagussett Yacht Club and to the west is well protected by seawall and riprap. The shore along Wessagussett Road from the yacht club to North Street is low and unprotected and damages from wave action occur to the road. The area between North Street and the bathhouse is partially protected by retaining walls, two short groins and annual placement of artificial sand fill. The bluff area from the bathhouse to Neck Street is poorly protected by occasional retaining walls, cribbing and riprap. The shore along River Street is low and badly eroded with considerable damage resulting to six private cottages and the road.

8. The improvements desired by local interests consist of development of the beach for recreational purposes and protection of the shore. Preliminary plans have been made by the Wessagussett Beach Development Committee for improvement of the area between the yacht club and the bathhouse through placement of sand fill, construction of groins and seawall, and riprap protection for the remaining area. This program is described in detail in Appendix E. Recent plans of the town include municipal development of the area near River Street with proposals for marina and parking on the Back River side and bathing beach development along the shore.

9. The study area has been separated into three natural sections for convenience in this study. These sections are as follows:

a. Wessagussett Road Section. - The area between the yacht club and the existing groin at the bathhouse.

b. Regatta Road Section. - The bluff area between the groin at the bathhouse and Neck Street.

c. River Street Section. - The area along River Street from Neck Street to the Fort Point seawall.

PART II. FACTORS PERTINENT TO THE PROBLEM

10. Geomorphology. - In general the shore line of New England is one of submergence of the land with respect to the level of the sea. The shore of North Weymouth lies in the southern fringe of the Boston structural basin which is a faulted depression. The shores of Boston Harbor furnish several examples of glacial delta plain shorelines, among which the North Weymouth and Quincy Neck shores of Weymouth Fore River and the south shore of Town River Bay are among the best. A delta plain shoreline is the product of melting glaciers where deposits are made at the ice margin and is characterized by concave and convex scallops.

11. Another form of shoreline, traces of which may be recognized on the shores of Weymouth Back River and the northern shore of North Weymouth, is the esker shoreline. Eskers are elongated ridges which formed narrow projecting points of the initial shoreline, but as waves very quickly destroy narrow ridges of unconsolidated sand and gravel, only those eskers in protected situations have survived to the present.

12. Littoral Materials. - Littoral materials in the study area consist of fine to coarse grey or tan sand and gravel, increasing in fineness offshore. Sand samples taken along profiles 1 and 6 in the Wessagussett Road Section indicated fine sand in the low water zone, medium sand in the 6-foot depth zone, fine sand in the 12-foot depth zone and silt beyond the 18-foot depth. Appendix A. includes a detailed analysis of samples taken in the area. Material dredged from the Weymouth Fore River Channel in the vicinity consists primarily of silt. Extensive areas of ledge have also been excavated in the past to deepen this channel.

13. Sources of Materials. - Erosion of the bluff in the Regatta Road Section has been serving as a source of material for the study area. In the past prior to construction of the seawall at Fort Point, erosion of the Point had served to supply littoral material to the area. The bluff, however, has also been receiving minor protection, thus reducing the availability of littoral materials.

14. Sand fill which is being placed, annually, at Wessagussett Beach in front of the bathhouse by the Town of Weymouth has been obtained from nearby sand pits. This placement of material has reportedly been about 1000 to 2000 cubic yards, annually. Material which lies in the navigation channel consists of silt and clay.

15. Littoral drift in the study area is primarily in a westerly direction, since the predominant northeast waves approach the study area at an angle to the shore with a westerly component.

16. Littoral Forces. - a. Tides. - Tides are semidiurnal. The mean and spring tide ranges are 9.5 and 11.0 feet, same as at Commonwealth Pier No. 5 in Boston. The highest tide of a 30-year record is 13.8 feet above mean low water. The highest storm tide recorded in 1851 was 15.0 feet above mean low water. Additional information on tides is given in Appendix B.

b. Winds. - United States Weather Bureau wind records for Boston, Massachusetts, the weather station located nearest to the study area, are available for the period October 1949 through September 1958. These data consist of hourly observations of wind speed and direction, based on sixteen points of the compass. From the wind rose, shown on Plate 1, it may be concluded that prevailing winds are from westerly directions. However, due to the topography of surrounding areas only winds from north-northwest to northeast, affect the study area. Storm winds of over 32 mph predominate from the northeast direction, as is shown on Plate 1. More detailed data are presented in Appendix B.

c. Waves. - No wave observations have been made in the study area. The maximum wave that can be generated in the area under storm conditions is estimated at about 3.0 feet.

d. Currents. - The United States Coast and Geodetic Survey tidal current tables for 1958 show that the maximum currents between Raccoon Island and Grape Island just north of Fort Point, are 0.5 knots on the flood and 0.4 knots on the ebb. The tidal currents in Weymouth Fore River, off Quincy Point are 0.6 on the flood and 0.9 on the ebb.

17. Shore Line and Offshore Changes. - Detailed information on shoreline and offshore changes is presented in Appendix C. The average annual rates of change from 1847 to 1958 of the mean high water (MHW) shoreline and the 6-, 12-, 18-, and 24-foot depth contours in the study area are shown below in Table 1. These changes are influenced by the dredging of the Weymouth Fore River channel, the placement of artificial sand fill and the construction of protective works in the area. Placement of sand fill annually, in the past 10 years, has balanced the rate of erosion at the bathhouse.

TABLE 1. Average Annual Rates of Change in Shoreline and Offshore Depth Contours (1847 - 1958)

	Change in Feet		
Contour	Wessagussett Road Section	Regatta Road Section	River Street Section
M H W	-1.5	-0.5	-1.0
6	-1.0 to -0.2	-1.0	-1.0 to +1.0
12	-0.5	+1.0	+1.0 to +3.0
18	-0.5	+1.0	+2.0
24	-2.0	-2.0	-0.5

(+) indicates accretion (-) indicates erosion

18. Prior Corrective Action and Existing Structures. - The shore to the west of Massasoit Road is protected by concrete seawall and riprap. The only structure seaward of the seawall is the Wessagussett Yacht Club, which is a frame building on piles with a pier extending out to sea.

19. Wessagussett Road Section. - The area between Massasoit Road and North Street, along Wessagussett Road, is low and unprotected from tides and waves. Annual expenditures by the Town of Weymouth on this portion of the road have reportedly been about $5,000. Opposite Massasoit Road, seaward from Wessagussett Road, there is a private residence protected by a concrete seawall. This seawall has been damaged in places. Opposite North Street lie the remains of an old groin.

20. The shore between North Street and the groin east of the bathhouse has been developed as a bathing beach by the Town of Weymouth. Two groins enclose this beach; the one opposite North Street built in 1950 and the other east of the bathhouse built about 20 years ago. The bathhouse consists of two small buildings built at the foot of the bluff. One of frame construction was built in the 1920's and the other, the smaller of the two, was built in the 1930's. The bank has been stabilized in this area by a system of concrete retaining walls which appear to be in fair condition. A concrete stairway from the top of the bluff gives additional access to the beach. The beach between the groins is nourished annually by placement of about 1000 to 2000 cubic yards of sand fill. The annual cost of maintaining the bathhouse, retaining walls, sidewalks and sand fill in this area is reported to range between $2,500 to $4,000 with an average of about $3,000.

21. Regatta Road Section. - The bluff area east of the bathhouse groin to Neck Street has had only limited uncoordinated protection of the bank by individual property owners, who have built railroad tie cribbing bulkheads, concrete retaining walls and rearranged available boulders, which were exposed through erosion of the bluff, to form short groins, about 20 feet in length. The only structure at the foot of the bluff in this area is a private marine railway and concrete boat platform. This is located about 500 feet east of the bathhouse.

22. River Street Section. - The area along River Street, between Neck Street and the intersection of River Street and Fort Point Road is low and unprotected. Six private cottages which stand seaward of River Street evidence considerable deterioration from wave attack.

23. The shore to the east of the study area along Fort Point Road, is protected by a State-built precast concrete seawall on stone base. This seawall is 3,350 feet long around Fort Point and has a top elevation of 15.0 and 16.0 feet above mean low water. At five points along Fort Point Road concrete steps have been provided to make the beach accessible. The westerly terminus of the seawall is marked by a 100-foot groin. The seawall was built about 10 years ago and appears to be in good condition.

24. Profiles. - Field survey work was undertaken by the Town of Weymouth, the cooperating agency, as part of their share in the cost of the study. This survey consisted of 10 profiles, 3 intermediate bluff sections and 8 surface samples. The profiles are shown on Plate 2 and are discussed in Appendix A. The average beach slopes from the beach berm to mean high water (MHW), to mean tide level (MTL), to mean low water (MLW) to the 6-, 12-, and 18-foot depth contours for the three sections of the study area are shown in Table 2. below. The steep offshore slopes in the Wessagussett Road section are mainly the result of proximity to the Weymouth Fore River channel.

TABLE 2. Beach Slopes

	Above MHW	MHW to MTL	MTL to MLW	MLW to 6	6 to 12	12 to 18
Wessagussett Road Section	1/9.5	1/12	1/25	1/34	1/13	1/8.5
Regatta Road Section	1/6.5	1/9	1/16	1/42	1/112	
River Street Section	1/6	1/10	1/30	Flat		

25. Volumetric Accretion and Erosion. - The study area has been experiencing general erosion of the shoreline. Table 1 lists annual rates of change of the high water shoreline and the 6-, 12-, 18-, and 24-foot contours. Since no comparative profiles are available in the area the annual volumes of accretion and erosion are computed on the basis of the information available by the shoreline changes. Table 3 shows rough estimates of annual volumetric accretion and erosion occurring at various depth zones of the beach at the three sections of the study area. It is indicated in this table that some offshore movement of littoral material may be taking place. The overall net result is a loss of material from the study area amounting to about 1000 cubic yards.

26. The portion of the Weymouth Fore River channel which lies opposite the Wessagussett Beach bathhouse has shoaled over a length of 1300 feet moving the 27-foot contour seaward an average of 38 feet annually from 1952 to 1957, which amounts to 1800 cubic yards annually, assuming an average shoaling of one foot in depth. This volume is about equal to the volume of sand fill placed annually on the public beach at the bathhouse by the Town of Weymouth.

TABLE 3. Average Annual Volumetric Accretion and Erosion (1847 - 1958)

Zone	Estimated Volumetric Change in Cubic Yards			
	Wessagussett Road Section	Regatta Road Section	River Street Section	Total
MHW - 6	-600	-700	-100	-1400
6 - 12	-100	0	+200	+ 100
12 - 18	-100	+400	+300	+ 600
18 - 24	-200	-200	+100	- 300
Total	-1000	-500	+500	-1000

(+) indicates accretion
(-) indicates erosion

PART III. ANALYSIS OF THE PROBLEM

27. Shore Processes Pertinent to the Problem. - Wave action and tidal flooding are the principal causes of damage to the shore of the study area. Waves approach the area from a northeasterly direction, contributing to a westerly movement of littoral drift. Tidal currents contribute to further movement of littoral drift in both westerly and easterly directions. The scalloped form of the shore and the bend in the channel probably cause tidal eddies in the study area which may deposit some littoral material offshore. Evidence of this is offered by the shoaling of the channel and the offshore area between the bathhouse and Fort Point. This shoaling has averaged about 1000 cubic yards, annually. Loss of material because of shore erosion amounts to about 1400 cubic yards, annually. An additional 600 cubic yards is lost annually from the offshore area within the limits of the study area in the vicinity of the navigation channel.

28. The general erosion along the Wessagussett Road Section has caused considerable damage to the road. The town has constructed two groins and in recent years has placed artificial fill to the area in front of the bathhouse, which has been developed as a public beach. If this protection is discontinued it is believed that the bathhouse structures would be critically undermined within a period of about 10 years. Low portions of the road are occasionally flooded and frequently damaged. At the present rate of erosion parts of this road would be completely destroyed within about 20 years if erosion in the area is not curbed.

29. Erosion of the bluff in the Regatta Road Section, which is the only natural supply of material in the area, has advanced to a point where it threatens the private properties seaward from Regatta Road. If no protection of the bluff is provided and the present rate of

erosion is allowed to continue the back yards of 16 homes will disappear in about 50 years and the structures will be undermined. Erosion of the bluff would have to continue an additional 50 to 100 years before Regatta Road is undermined.

30. The low area at the River Street Section has eroded to such an extent that six houses are now open to wave attack at high tide. If no protection is provided these structures would be eventually destroyed and River Street undermined in about 10 to 20 years.

31. The area between River Street and Fort Point, fronting Fort Point Road, appears to be adequately protected at present by a stone groin and a precast concrete seawall on stone base.

32. Methods of Correcting Problem Conditions. - Precast concrete seawall protection has apparently been effective to check erosion at Fort Point. Such a seawall has aesthetic advantages and may be desirable where children play in the vicinity. A riprap mound, however, would be more suitable for protection of the bluff section, since it can withstand back pressures better than a comparable precast concrete structure. Sand-fill is a desirable method of shore protection, especially where it can be used for recreational purposes. Since this area is already in limited use as a public bathing beach, expansion of the facilities by construction of a protective sand beach merits consideration. Sand fill, however, should be limited in the area near the bathhouse, because of proximity to the navigation channel, and should consist preferably of medium to coarse sand for better stability. Retention of sand fill by a groin is particularly essential in the Wessagussett Road Section to prevent shoaling of the Yacht Club anchorage and the channel.

33. Design Criteria Adopted. - Proposed shore protection measures are designed for ordinary conditions of comparatively frequent occurence (about once a year), they are not intended to provide complete protection to shore and waterfront structures in event of a hurricane or exceptional storms of infrequent occurence, although even under these conditions some protection will be afforded. Specific design criteria for protective works in the study area are described in detail in Appendix D and are summarized below:

a. Design Tide. - The design tide is the maximum elevation which occurs about once a year. Tide records at Boston indicate that stages of about 3.1 feet above the plane of mean high water occur about once each year. The design tide, therefore, is 12.6 feet above mean low water.

b. Design Wave. - The design wave is the maximum wave that can arrive at the study area once a year under storm conditions of 50 mph wind. The maximum wave that can be generated under such conditions is 3.0 feet with a period of 3.1 seconds. A design wave of 3.0 feet is, therefore, used in this study. The direction of the design wave is from the north northeast.

c. Wave Run-Up. - Run-up on structures located at various elevations, expressed in feet above still water level, are shown below. These have been estimated from data presented in Beach Erosion Board Technical Memorandum No. 64.

2 feet at design tide level
3 feet at mean high water level
2½ feet at mean tide level
1½ feet at mean low water level

PART IV. PLANS OF PROTECTION

34. General. - A plan of protection and improvement has been prepared by the Town of Weymouth as described in Appendix E. The town plan and recent desires of the town for development of the River Street area have been considered in developing suitable plans of protection for the area. The plans are shown on Plate 2 and described below:

35. Wessagussett Road Section - Sand Fill Plan. - This plan is designed to provide protection from shore erosion in the area and improvement of the present public bathing facilities. The plan consists of construction of a sand beach generally 125, 175 and 35 feet in width, at the west end, 300 feet east of the west end and at the bathhouse, respectively, with a berm elevation of 14.0 feet above mean low water by placement of about 45,000 cubic yards medium to coarse sand; construction of a groin 375 feet long adjacent to the Wessagussett Yacht Club property to retain the fill. The groin would incorporate a 42-inch drain extension with a tide gate at the offshore end, and a manhole near its shore end. Two additional manholes along the beach are necessary to make connections from existing drains in this area. The drainage improvement would eliminate two drains now discharging on the beach. The groin should have a navigation marker at its seaward end. Periodic nourishment, estimated to be 1,000 cubic yards per year, will be required to maintain the beach.

36. Regatta Road and River Street Sections - Sand Fill Plan. - This plan has been developed to provide the necessary shore protection in the Regatta Road and River Street sections and improve the area as a public bathing beach. This plan is conditioned on public ownership and clearance of the properties seaward from River Street. The plan features construction of a sand beach by placement of about 140,000 cubic yards of medium to coarse sand generally 125 feet wide along River Street and most of Regatta Road ending at a 350-foot long groin about 500 feet east of the west end of the Regatta Road Section. Sandfill should not be placed in this 500-foot portion of the section because of proximity of the navigation channel. Instead, a stone mound, about 500 feet in length, is included, to protect the bluff. Periodic nourishment, estimated to be 1,000 cubic yards per year, will be required to maintain the beach.

37. Regatta Road Section - Alternative - Stone Mound Plan. - This plan is one of smaller first cost designed to curb erosion of the shore and bluff in this area if the town decides that it is not desirable to provide the additional beach area. The plan consists of a stone riprap mound, about 1600 feet long, to be constructed along the base of the bluff to elevation 15.0 feet above mean low water which is about one-half foot above the estimated design run-up. The plan is generally in accord with the town plan.

38. River Street Section - Alternative - Stone Mound Plan. - This plan is designed to check erosion in this area and to reduce damages from wave action to private cottages and River Street. This is an alternative method of protection to the sand fill plan. It consists of a stone mound to elevation 15.0 feet above mean low water, 500 feet long, seaward from the cottages off River Street. A precast concrete seawall on stone riprap base, similar in construction to the Fort Point Seawall, could be substituted for the stone mound, if so desired.

PART V. ECONOMIC ANALYSIS

39. General. - The economic anlayses presented herein are for the plans of protection which are considered in this report in the three sections of the study area. It appears that the plans would have no adverse effect on adjacent shores.

40. Estimates of First Cost. - Detailed breakdown of costs are given in Appendix F. Given below for the four plans studied are estimated first costs including engineering, design, supervision and administration. These costs are based on the December 1958 price level. Estimates of investment include allocated pre-authorization study costs.

Estimated First Costs:	Project	Investment
(a) Wessagussett Road Section - Sand Fill Plan	$122,000	$125,000
(b) Regatta Road and River Street Sections - Sand Fill Plan	$281,000	$286,000
(c) Regatta Road Section - Alternative - Stone Mound Plan	$ 31,000	$ 35,000
(d) River Street Section - Alternative - Stone Mound Plan	$ 10,000	$ 11,000

41. In addition to restoring adequate protective and recreational beaches, and other shore protection measures, local interests would provide at their own expense parking areas, and apurtenant items to facilitate recreational use. Such facilities are required for realization of the maximum recreational benefits from the beach developments of the two sand fill plans. These costs are considered self-amortizing and have not been included in the first costs of the above plans.

42. The cost of a precast concrete seawall in place of the stone mound in the River Street Section is estimated to be about the same and has not, therefore, been included.

43. Estimates of Annual Charges. - Interest and amortization charges have been computed using an interest rate of 2.5 percent for Federal and 3.0 percent for Non-Federal investment over a 50-year economic life of project. Estimated annual charges are given below:

Plan	Interest and Amortization		Maintenance	Total
	Federal	Non-Federal	Non-Federal	
(a) Wessagussett Road Section - Sand fill plan	$1,500	$3,200	$2,000	$6,700
(b) Regatta Road & River St. Sections - Sand Fill Plan	$3,400	$7,400	$2,000	$12,800
(c) Regatta Road Section - alternative Stone Mound Plan	$100	$1,300	$300	$1,700
(d) River Street Section - alternative Stone Mound Plan	$100	$ 300	$100	$500

44. Estimates of Benefits. - The estimated benefits include direct damage prevented and recreational benefits. These are discussed in detail in Appendix G. Direct damages prevented are based on records of expenditures for repairs on public roads and facilities and on estimates of damages and loss of land to private properties. Recreational benefits were estimated based on attendance distribution curves developed from daily attendance records at Eastern Point Beach Park in Groton, Connecticut. Total seasonal attendance for Wessagussett Road Section - Sand fill plan is estimated at 188,000 persons excluding 70,000 present attendance, and for Regatta Road and River Street Sections - sand fill plan is estimated at 242,000 persons, the total prospective attendance of 500,000 is equal to the potential of the town estimated at 10 times the present population of about 50,000 persons. A list of evaluated benefits follows:

Plan	Recreational (Public)	Direct Damages Prevented		Total
		Public	Private	
(a) Wessagussett Road Section Sand fill plan	$33,500	$4,000	$200	$37,700
(b) Regatta Road & River St. Sections - Sand fill plan	$57,000	$2,200	$800	$60,000

Plan	Recreational (Public)	Direct Damages Prevented		
		Public	Private	Total
(c) Regatta Road Section - alternative Stone Mound Plan	0	$200	$800	$1,000
(d) River Street Section - alternative Stone Mound Plan	0	$2,000	$300	$2,300

45. Justification of Improvements. - The estimated annual benefits and costs and the resulting ratios of benefits to costs are summarized below:

Plan	Estimated Annual		
	Benefits	Costs	B/C Ratio
(a) Wessagussett Road Section Sand Fill Plan	$37,700	$6,700	5.6
(b) Regatta Road & River Sections Sand Fill Plan	$60,000	$12,800	4.7
(c) Regatta Road Section - alternative Stone Mound Plan	$1,000	$1,700	0.6
(d) River Street Section - Alternative Stone Mound Plan	$2,300	$500	4.6

46. Federal, Non-Federal Public, and Private Interests. - There is no Federal owned property in the study area. Recreational benefits are considered to be all non-Federal public benefits. Benefits from direct damages prevented are non-Federal public or private depending upon ownership of lands being protected and damages being eliminated. The percentages of non-Federal public and private benefits are shown below.

Plan	Percent of Total Benefits		
	Public	Private	Total
(a) Wessagussett Road Section - Sand Fill Plan	99%	1%	100%
(b) Regatta Road & River Street Sections - Sand Fill Plan	99%	1%	100%
(c) Regatta Road Section - Alternative Stone Mound Plan	20%	80%	100%
(d) River Street Section - Alternative Stone Mound Plan	87%	13%	100%

47. Apportionment of Costs. - Public Law 826, 84th Congress established a policy of Federal aid in the restoration and protection of shores of the United States, its territories and possessions. The maximum Federal share of the costs is one-third of the first cost of construction of economically justified projects and applies in the case where all benefits are public in character. Since the Regatta Road Section - Alternative Stone Mound Plan is not justified by evaluated benefits there would be no Federal participation therein. In cases where private benefits result, the percentage of Federal participation is based on one-third the ratio of public benefits to total benefits. Apportionment of costs of the considered plans is made on the basis of Federal aid to the extent of one-third the percentage of public benefits to total benefits as follows:

Plan	Project First Cost		
	Federal	Non-Federal	Total
(a) Wessagussett Road Section - Sand Fill Plan	(33%) $40,000	(67%) $82,000	$122,000
(b) Regatta Road & River Street Sections - Sand Fill Plan	(33%) $93,000	(67%) $188,000	$281,000
(c) Regatta Road Section - Alternative Stone Mound Plan	(0%)	(100%) $31,000	$31,000
(d) River Street Section - Alternative Stone Mound Plan	(29%) $2,900	(71%) $7,100	$10,000

48. Coordination with other Agencies and Local Cooperation. - Close coordination has been maintained with the Town of Weymouth, the cooperating agency, and the Division of Waterways, Massachusetts Department of Public Works, throughout the study. The Town of Weymouth has furnished the field survey for this study as part of their cooperation in the study. The cooperating agency and the State of Massachusetts have been informed of the findings and recommendations contained in this report. They consider the report satisfactory and that the proposed plans of protection and improvement are desirable and necessary. Both the cooperating agency and the Massachusetts Division of Waterways desire a concrete seawall in back of the sand fill, an item excluded from the plans of improvement as non-essential for the protection of the shore. Local officials contacted have indicated that the properties seaward of River Street would probably be taken in the future by the Town of Weymouth as part of further municipal development in the area, and they unanimously favored both sand fill plans at a meeting on January 13, 1959. Local interests should be required to:

a. Obtain approval by the Chief of Engineers, prior to commencement of work, of detailed plans and specifications for the project, and also the arrangements for prosecuting the work on that project.

b. Assure continued public ownership of the shore upon which the amount of Federal participation is based, and its administration for public use during the economic life of the project.

c. Assure maintenance and repair, including periodic beach nourishment, during the economic life of the works as may be required to serve the intended purpose.

d. Provide at their own expense all necessary lands, easements and rights-of-way.

e. Assure that water pollution that would endanger the health of bathers will not be permitted.

f. Provide suitable appurtenant facilities, such as parking, bathhouse, access, etc., to the extent necessary for realization of evaluated benefits.

PART IV. CONCLUSIONS AND RECOMMENDATIONS

49. The Division Engineer concludes that the following are practicable plans for protection and improvement of Wessagussett Beach.

a. Wessagussett Road Section - Sand Fill Plan. Widening this section of beach by direct placement of about 45,000 cubic yards of suitable sand fill, as shown on Plate 2, construction of a groin 375 feet long containing a drain pipe with a tide gate and suitable navigation marker, and construction of drainage facilities.

b. Regatta Road and River Street Section - Sand Fill Plan. Direct placement of about 140,000 cubic yards of suitable sand fill along River Street and most of the bluff area as shown on Plate 2, construction of a stone groin, 350 feet long and construction of a stone mound, 500 feet long at the westerly end of Regatta Road Section. This plan requires public ownership of the properties seaward of River Street.

50. The projects are economically justified by evaluated public and private benefits. These benefits warrant 33 percent participation by the United States in the first cost of construction in accordance with the provisions of Public Law 826, 84th Congress, providing suitable appurtenant facilities are provided to the extent that the benefits may be realized.

51. Alternative plans of protection which have been considered for the Regatta Road and River Street Sections, are unfavorable for Federal improvement for a stone mound at the Regatta Road Section and economically justified for a stone mound or seawall, for the River Street Section. The stone mound plan at Regatta Road Section is unfavorable

for Federal improvement on the basis of evaluated benefits which may be used for the economic justification of Federal beach erosion projects. This plan, however, may merit consideration for local undertaking if additional secondary local benefits are found to exist. The plan for the River Street Section consists of construction of a stone mound or concrete seawall, 500 feet long, which would justify 29 percent participation by the United States in the first cost of construction. This plan is feasible if the sand fill plan for the Regatta Road and River Street Sections is not undertaken by local interests.

52. Recommendations. - The Division Engineer recommends that the United States adopt projects at Wessagussett Beach, Weymouth, Massachusetts, authorizing Federal participation by contribution of Federal funds in amount equal to thirty-three percent the first costs of the following plans:

a. Wessagussett Road Section - Sand Fill Plan. - Widening about 1,000 feet of beach by direct placement of about 45,000 cubic yards of suitable sand fill as shown on Plate 2, construction of a stone groin, 375 feet long containing a drain pipe with a tide gate and construction of drainage facilities.

b. Regatta Road and River Street Sections - Sand Fill Plan. - Widening about 1600 feet of beach by direct placement of about 140,000 cubic yards of suitable sand fill along River Street and Regatta Road, construction of a stone groin, 350 feet long and construction of a stone mound, 500 feet long, along the westerly end of Regatta Road Section.

53. Prerequisite for construction of the Regatta Road and River Street Sections - Sand Fill Plan is public ownership of the shore seaward of River Street. If this shore continues under private ownership in the future, the Division Engineer recommends an alternative project for protection of River Street Section, Federal participation in which would amount to twenty-nine percent of the first cost. This plan consists of construction of a stone mound or seawall, 500 feet long.

54. The recommended Federal participation is subject to the conditions that local interests will:

a. Obtain approval by the Chief of Engineers, prior to commencement of work, of detailed plans and specifications for the project, and also the arrangements for prosecuting the work on that project.

b. Assure continued public ownership of the shore upon which the amount of Federal participation is based, and its administration for public use during the economic life of the project.

c. Assure maintenance and repair, including periodic beach nourishment, during the economic life of the works as may be required to serve the intended purpose.

d. Provide at their own expense all necessary lands, easements and rights-of-way.

e. Assure that water pollution that would endanger the health of bathers will not be permitted.

f. Provide suitable appurtenant facilities, to the extent necessary for realization of evaluated benefits.

55. The estimated amounts of Federal participation in the first costs of the projects, in accordance with the foregoing recommendations, are $40,000 for the Wessagussett Road Section - Sand Fill Plan and $93,000 for the Regatta Road and River Street Sections - Sand Fill Plan, or $2,900 for the River Street Section - Alternative - Stone Mound Plan.

ALDEN K. SIBLEY
Brigadier General, U. S. Army
Division Engineer

APPENDIX A

DESCRIPTION AND COMPOSITION OF BEACHES

1. General. - Detailed descriptive data and data on composition of the shore were obtained from a detailed field inspection on March 25, 1958 and subsequent inspections, from field surveys of May, June, and September 1958, and from aerial photographs taken February 3, 1958.

2. Beach Profiles. - Ten profiles and three intermediate bluff sections were taken in the study area in connection with this study. Profiles 1 through 6 are located in the Wessagussett Road Section, Profiles 7 through 9 in the Regatta Road Section and Profile 10 in the River Street Section. These profiles are shown on Plate 2. Beach slopes vary between profiles with generally steeper slopes above mean tide level (MTL). Offshore slopes of Profiles 1 to 7 are appreciably affected by the proximity of the Weymouth Fore River Channel. Table A-1 lists average beach slopes along various sections of the profiles. In this table the column "above MHW" lists the slope of beach above mean high water to the beach berm, if such exists. Other intervals are between mean-high water (MHW), mean-tide level (MTL), mean-low water (MLW), and the 6-, 12-, 18-, and 24-foot depth contours below mean low water. A slope "Flat" is taken to be one which is 1 on 200 or flatter.

3. Beach Samples. - Eight surface sand samples were taken in the Wessagussett Road Section along Profiles 1 and 6 at mean low water and at the 6-, 12-, and 18-foot depth contours. Table A-2 shows the median diameter and the gradation in grain size of each sample. The material consists of gravelly sand in the tidal zone, fine sand in the low water zone, medium sand in the 6-foot depth zone, fine sand in the 12-foot depth zone, and silt in the 18-foot depth zone.

TABLE A-1. BEACH SLOPES

Profile No.	Above MHW	MHW to MTL	MTL to MLW	MLW to 6	6 to 12	12 to 18	18 to 24
1	1/8.5	1/8.5	1/23	1/48	1/17	1/7.5	
2	1/5.5	1/13	1/42				
3	1/6	1/10	1/50				
4	1/17	1/15	1/16	1/48	1/11	1/9	
5	1/9	1/15	1/12	1/16			
6	1/12	1/10	1/9	1/22	1/12	1/9	1/9
7	1/6	1/7	1/20	1/29	1/37	1/11	1/3.5
7A	1/6						
8	1/6.5	1/9	1/14	1/48	1/100		
8A	1/7						
9	1/6.5	1/10	1/15	1/50	Flat		
9A	1/7						
10	1/6	1/10	1/30	Flat			

TABLE A-2. ANALYSIS OF SAND SAMPLES

Profile No.	Position	Median Diameter (m.m.)	Characteristics of Material in Percent: Silt or Clay .074 less mm	Fine Sand .074-.42 mm	Medium Sand .42-2.00 mm	Coarse Sand 2.00-4.76 mm	Fine Gravel 4.76-19.1 mm	Coarse Gravel 19.1-76.2 mm
1	MLW	.15	15.0	81.7	3.3	-	-	-
	6	1.9	9.7	23.9	16.6	12.5	29.5	7.8
	12	.37	23.9	28.5	17.1	7.6	13.6	9.3
	18	-	83.0	15.5	1.5	-	-	-
6	MLW	.25	20.0	36.3	14.3	10.3	11.2	7.9
	6	1.9	10.6	24.8	14.6	7.4	21.0	21.6
	12	.15	7.4	89.6	1.4	1.0	.6	-
	18	-	61.0	26.1	5.2	2.2	5.5	-

4. Detailed Description. - Detailed description of the shore between Wessagussett Yacht Club and the intersection of River Street and Fort Point Road follows. Elevations are referred to the plane of mean low water unless otherwise specified.

A. Wessagussett Road Section (Pilgrim Road to North Street)

(1) Shore Length: Approximately 600 feet

(2) Ownership: Public

(3) Beach Use: Yacht Club and limited bathing

(4) Public Facilities: None (Yacht Club at west end)

(5) Beach Width above HW: 20 to 30 feet

(6) Composition of Shore: Shingle above mid-tide, fine to medium sand mixed with gravel below mid-tide elevation. Boulders strewn along beach. Large amount of clam shells and live snails throughout segment.

(7) Structures. - Concrete sea wall about 150 feet long extending from yacht club eastward, top elevation about 12 feet. A lower elevation sea wall about 140 feet long extends eastward therefrom in front of a house. An open timber pile pier with wood decking is located at west extreme of segment. An 18" concrete pipe storm drain discharging at about mid-tide elevation, is located at about the center of the segment 250-300 feet east of the yacht club. A 6" storm drain which discharges on the top of the beach is located about 200 feet east of the yacht club. On 3/25/58 both drains were discharging brownish water with swampy odor. No odor of cesspool pollution was evident.

(8) Erosion or Storm Damage. - Indications of erosion of the shore. No damage visible.

(9) Character of Development. - Wessagussett Yacht Club at west end. Inexpensive summer and year-around cottages south of Wessagussett Road.

B. Wessagussett Road Section. - (Existing Town Beach between North Street and bathhouse groin).

(1) Shore Length: Approximately 400 feet

(2) Ownership: Public

(3) Beach Use: Bathing.

(4) Public Facilities: Bathhouse, float, life guard service.

(5) Beach Width above HW: About 80 feet wide at westerly groin, decreasing to 30 about 200 feet eastward.

(6) Composition of Shore: Shingle mixed with clam shells with some medium to fine sand above HW at westerly groin. Scarp at HW or fronting bathhouse and sea wall.

(7) Structures: Two low stone groins each about 150 feet long located at west and east limit of area. A low concrete sea wall about 250 feet long with top elevation ranging from about elevation 12 to 13 feet extends from west end of segment to east end of bathhouse. Concrete retaining wall about 200 feet long with top elevation of about 20 to 25 feet is located about 10 feet behind seawall.

(8) Erosion or Storm Damage: About 200 feet of concrete sidewalk along seawall destroyed and remainder damaged. Base of seawall undermined at a point about 150 feet east of west end of wall. Concrete seawall deteriorating at several points. Concrete steps broken.

(9) Character of Development: Public bathing beach. Street on glacial till bluff behind beach.

C. Regatta Road Section (Bluff Area).

(1) Shore Length: Approximately 1,650 feet.

(2) Ownership: Beach and seaward face of bluff owned by Town, landward of Town ownership privately owned.

(3) Beach Use: Small amount of bathing and fishing.

(4) Public Facilities: None.

(5) Beach Width above HW: 5 to 25 feet.

(6) Composition of Shore: Fine to coarse gravel with clam shells. At the west end there is evidence of red and blue clay at about the midtide elevation. Bluff composed of glacial till.

(7) Structures: Several short, low boulder groins. Short boulder revetment along toe of bluff at west end. Several short timber retaining walls scattered throughout.

(8) Erosion or Storm Damage. - Erosion at toe of glacial till bluff throughout. Steps and bulkheads damaged. About center of area there is a 4" and a 10" drain from Regatta Road draining onto the bluff near top which has eroded a gully 2 to 3 feet deep down the entire height of bluff. In general there has been little scouring of the bluff, as indicated by vegital cover.

(9) Character of Development: Medium summer and year-around residences.

D. River Street Section (Low Area East of Bluff Area.)

(1) Shore Length: Approximately 500 feet.

(2) Ownership: Private.

(3) Beach Use: Limited bathing.

(4) Public Facilities: None.

(5) Beach Width above HW: 0 - 5 feet.

(6) Composition of Shore: Shingle, pea gravel and shell. Low marsh area and a pond behind road.

(7) Structures: Stone groin about 100 feet long located at extreme east end of segment.

(8) Erosion or Storm Damage: Some damage to houses and low timber bulkheads fronting houses. Embankment holding road eroded. Road patched, apparently damaged during storms.

(9) Character of Development: Low cost summer and year-around cottages, constructed on piles and located on beach with front against roadway.

APPENDIX B

LITTORAL FORCES

1. Tides: Tides in the study area are semidiurnal. The mean and spring ranges are 9.5 and 11.0 feet, the same as occurs at Commonwealth Pier No. 5 in Boston. It is considered that the records from the tide station at Boston also apply to Wessagussett Beach. Unless otherwise stated the elevations given herein are referred to the plane of mean low water.

2. Inspection of 30.3 years of record at Boston Harbor, covering the period August 1921 through March 1952 (excluding January-April 1945), reveals that the highest tide of record was 13.8 feet above mean low water and occurred only once during the period (April 21, 1940). Table B-1 shows the number of occurrences of tides exceeding the plane of mean high water in increments of one-tenth foot. These statistics are of heights which have actually occurred and include the combined effects of lunar and solar attraction, and storm forces.

TABLE B-1. Boston Harbor, Massachusetts - Number of Tides exceeding Mean High Water During Period August 1921 through March 1952.

Feet Above MHW	Number of Occurrences*	Average Number of Occurrences per Year*
4.3	1	0.03
4.2	2	0.06
4.1	2	0.06
4.0	2	0.06
3.9	2	0.06
3.8	2	0.06
3.7	3	0.1
3.6	4	0.1
3.5	5	0.2
3.4	7	0.2
3.3	14	0.5
3.2	21	0.7
3.1	32	1.1
3.0	44	1.5
2.9	67	2.2
2.8	83	2.7
2.7	110	3.6
2.6	144	4.8
2.5	205	6.8
2.4	277	9.1
2.3	358	11.8
2.2	463	15.3
2.1	560	18.5
2.0	741	24.5

*equaling or exceeding the stated elevation

3. Storm Tides. - High velocity winds increase the normal predicted tides in varying amounts depending upon direction, duration and severity of the winds, the hydrography of the nearshore and the shelter of the location. Table B-2 shows maximum elevations recorded at Boston since 1933 and the difference between the elevations which actually occurred and those predicted on the basis of normal forces. Elevations of 14.8, 15.0 and 13.9 were recorded in December 1909, April 1851 and March 1851, respectively. However, the gaging stations for these former observations were located at points in the harbor other than at Commonwealth Pier and therefore the observations are not directly comparable to those observed subsequent to 1933.

TABLE B-2. RECENT BOSTON STORM TIDES

Date	Tide Elevation in Ft.		Differences in Feet	
	Observed	Predicted	Height Above Predicted Elevation	Height Above M.H.W.
1/28/33	13.5	10.3	3.2	4.0
9/21/38	11.3	10.6	0.7	1.8
4/21/40	13.8	11.7	2.1	4.3
11/20/45	12.8	12.0	0.8	3.3
11/22/45	12.7	11.6	1.1	3.2
11/30/45	12.5	8.9	3.6	3.0
8/31/54	13.1	9.9	3.2	3.6
9/11/54	11.0	9.6	1.4	1.5

4. Prevailing Winds. - United States Weather Bureau wind records for Boston, Massachusetts, the weather station located nearest to the study area, for the period October 1949 through September 1958 were used in this study. These data consist of hourly observations of wind speed and direction based on sixteen points of the compass. A wind rose made from these data is shown on Plate 1 and a summary of wind data are presented in Table B-3. It is worthy of note however, that due to the topography of surrounding areas only winds from about north-northwest through north to northeast effect the study area.

5. The wind rose indicates a preponderance of westerly winds with greatest duration from the southwest. However, by combining winds within quadrants it is shown that prevailing winds are from the northwest quadrant. Considering the effective winds in this study the rose shows greatest duration from north-northwest and about equal duration from the north and northeast. The greatest durations of winds over 35 miles per hour occur from the northeast. A summary of the number of gales (continuous winds with velocities over 32 miles per hour) occurring at Boston during the 75 year period of 1870 through 1945 show that 160 gales occurred of which 50 percent were from the northeast. A tabulation of wind statistics for the Boston station is given in Table B-3.

TABLE B-3. WIND DATA, BOSTON, MASSACHUSETTS
October 1949 - September 1958

Direction	Duration in Hours, Speed in Miles per hour: 0-3	4-7	8-12	13-18	19-24	25-31	32-38	39-46	Over 47	Total	%Total Duration	Average Annual Speed MPH	Wind Movement in miles	% Total Movement
N	96	599	1498	1177	356	121	15	3	-	3865	4.9	12.4	47,902	4.6
NNE	70	381	876	752	360	164	31	5	1	2640	3.3	13.7	36,194	3.4
NE	92	485	982	1004	523	232	87	32	11	3448	4.4	14.7	50,525	4.8
ENE	92	417	777	922	434	208	54	16	4	2924	3.7	14.5	42,468	4.0
E	99	453	1249	1216	343	128	50	22	2	3562	4.5	13.3	47,156	4.5
ESE	100	543	1448	1263	232	67	11	-	4	3668	4.7	11.8	43,438	4.1
SE	104	569	1234	863	126	22	-	-	1	2919	3.7	11.0	32,038	3.1
SSE	77	528	1021	470	83	24	3	2	1	2209	2.8	10.4	22,969	2.2
S	89	798	1447	930	245	59	13	3	-	3584	4.5	11.2	40,207	3.8
SSW	82	774	1905	1850	686	215	46	15	3	5576	7.1	13.4	74,674	7.1
SW	93	952	3789	4045	1118	268	33	3	-	10301	13.1	13.3	137,139	13.1
WSW	71	569	1910	1981	500	95	15	1	-	5142	6.5	12.9	66,125	6.3
W	73	635	1978	2110	835	264	69	6	-	5970	7.6	14.1	84,045	8.0
WNW	73	861	2819	3089	1364	510	65	11	-	8792	11.1	14.4	126,679	12.1
NW	85	745	2319	3097	1399	550	88	7	4	8294	10.5	15.0	124,176	11.8
NNW	72	541	1750	2114	778	182	21	2	-	5460	6.9	13.7	74,924	7.1
Calms										534	0.7			
Totals										78,888	100.0	13.3	1,050,324	100.0

6. Waves. - No wave observations have been made in the study area. The deep water wave statistics presented in Beach Erosion Board Technical Memorandum No. 55 are not applicable to this sheltered area. Bretschneider's Formula for generation of wind waves in shallow water indicates a wave height of 3.0 feet in the area accounting for limitations in width of fetch. Additional information concerning the design wave is presented in Appendix D.

7. Other waves which reach the study area are generated by vessels navigating the channel. Such waves are a nuisance to small boats moored in the area, but lack the duration necessary to have significant adverse effects on the shore.

APPENDIX C

SHORE LINE AND OFFSHORE CHANGES

1. Basic Data. - A map showing the position of the mean high water line at Wessagussett Beach, for the years 1847 and 1948, the position of the 6-, 12-, and 18-foot depth contours for the years 1846-48, 1863, 1893 and 1952, and the position of the 24-foot depth contour for the years 1863 and 1952 was furnished by the Beach Erosion Board for use in this study. Shore line and offshore data for 1958 were obtained from a survey furnished by the Town of Weymouth. Shore line and offshore contours are shown on Plate 1. Sand fill placed annually on the public beach near the bathhouse has influenced shoreline and offshore changes in the Wessagussett Road Section. Offshore changes in this area are further affected by the proximity of the Weymouth Fore River Channel.

2. Mean High Water Shore Line Changes. - In the period between 1847 and 1948 the shore line receded 140 to 190 feet in the Wessagussett Road Section (the area between the Yacht Club and the bathhouse). Recession in the Regatta Road Section and the River Street Section (from the bathhouse to the Fort Point seawall) amounted to about 100 feet and varied from no change in the vicinity of the seawall to 140 feet at a point just east of the bathhouse. In the period between 1948 and 1958 there has been negligible change in the shore line. There has been some local accretion of 20 to 30 feet in the vicinity of the Yacht Club and the bathhouse. There has also been some local recession of the shore line of up to about 40 feet at about half-way between the Yacht Club and the batthouse.

3. Changes in the 6-foot Depth Contour. - In the period 1846-48 to 1863 the 6-foot depth contour showed accretion up to 230 feet opposite the bathhouse and accretion up to 400 feet in the River Street Section. No change is indicated in this period at the Yacht Club or at the area just east of the bathhouse. In the period 1863 to 1893 there was general recession in the area which amounted to 230 feet in the vicinity of the batthouse, 50 feet in the Regatta Road Section and 380 feet in the River Street Section. There was no change in the vicinity of the Yacht Club in this period. In the period 1893 to 1952 a slight recession of 20 to 50 feet in the Wessagussett Road Section is followed by accretion of about 100 to 120 feet in the Regatta Road and River Street Sections. In the period 1952 to 1958 the area at the Wessagussett Road Section experienced alternating accretion and recession of up to 50 feet at points. The Regatta Road and River Street Section suffered a recession of up to 120 feet.

4. Changes in the 12-foot Depth Contour. - In the period 1846-48 to 1863 there was no change in the vicinity of the Yacht Club. There was accretion near the bathhouse of up to 200 feet which was followed by accretion of 40 to 400 feet in the Regatta Road and River Street Sections. At Fort Point there was recession in this period of up to 400 feet. The period 1863 to 1893, which followed, exhibited general recession of the 12-foot depth contour. This recession reached 220 feet in the Wessagussett Road Section and varied between 100 and 340 feet in the Regatta Road and River Street Sections. In the period 1893 to 1952 recession of 40 feet at the Yacht Club and the bathhouse, then recession of about 40 feet at the bathhouse, alternating recession and accretion of up to 40 feet in the Regatta Road and River Street Sections and finally accretion of up to 400 feet at Fort Point. In the period 1952 to 1958 there has been general accretion of 40 to 60 feet in the area between the Yacht Club and the bathhouse and no change is indicated from the bathhouse to the Fort Point seawall.

5. Changes in the 18-foot Depth Contour. - In the period 1846-48 to 1863 there has been general accretion in the area, except where no change is indicated in the vicinity of the bathhouse. Accretion to the west of the bathhouse was up to 120 feet and to the east of the bathhouse amounted up to 320 feet. The period 1863 to 1893 experienced general recession which varied from 100 to 200 feet in the Wessagussett Road Section and from 60 to 220 feet in the Regatta Road and River Street Sections and Fort Point. In the period 1893 to 1952 there was accretion of about 120 feet at the Yacht Club, accretion of 0 to 60 feet at the bathhouse, accretion of 0 to 80 feet in the Regatta Road and River Street Sections and recession of up to 150 feet at Fort Point. In the period 1952 to 1958 there was recession of 120 feet at the Yacht Club and fluctuation from 20 feet accretion to 40 feet recession at the bathhouse. In the same period in the Regatta Road and River Street Sections changes in the 18-foot depth contour varied from 70 feet recession near the bathhouse to 70 feet accretion near the Fort Point seawall.

6. Changes in the 24-foot Depth Contour. - The 24-foot depth contour receded in the period 1863 to 1952 about 140 to 240 feet in the Wessagussett Road Section and about 100 to 240 feet in the Regatta Road and River Street Sections. In the period 1952 to 1958 there has been accretion of up to 80 feet in the Wessagussett Road Section, recession of about 20 feet just east of the bathhouse and accretion of 140 feet near Fort Point. Dredging of the Weymouth Fore River Channel has been most influential in effecting recession of the offshore area particularly in the Wessagussett Road Section where the proximity of the channel to shore is greatest.

7. Rates of Annual Change in Shoreline and Offshore Contours. - There have been considerable fluctuations in the location of the mean high water shoreline and the offshore contours at Wessagussett Beach.

The natural shore processes in the area have been considerably affected in the past by protective works and artificial sand placement on the beach, as well as maintenance of the existing Federal navigation channel in Weymouth Fore River. The overall changes, however, over the period of record have amounted to a general recession of the shoreline in the study area which varies from 1.5 to 0.5 to 1.0 foot annually in the Wessagussett Road, Regatta Road and River Street Sections, respectively. The 6-foot depth contour has receded about 1.0 foot annually in the study area, except a recession of about 0.2 foot at the bathhouse and accretion of about 1.0 foot annually at Fort Point. The 12-foot depth contour shows a recession of 0.5 foot annually in the Wessagussett Road Section accretion of 1.0 foot in the Regatta Road and River Street Sections and about 3.0 feet accretion at Fort Point. The annual rate of change to the 18-foot depth contour varies from recession of 0.5 foot at the Yacht Club to accretion of 2.0 feet in the vicinity of the Fort Point seawall. The 24-foot depth contour shows an average recession of 2.0 feet annually with only 0.5 foot at the River Street Section. The effect of the proximity of the navigation channel is apparent in the rate of change indicated by the 24-foot depth contour. It may be concluded from the above that the Wessagussett Road Section, which is in closer proximity to the navigation channel, is experiencing the most serious erosion in the study area.

APPENDIX D

DESIGN ANALYSIS

1. General. - This appendix is a resumé of the design methods and techniques used in the study. The design methods in general follow Beach Erosion Board Technical Report No. 4 "Shore Protection, Planning and Design, (Revised February 1957)".

2. Design Tide Elevation. - The maximum elevation of tide occurring with a frequency of approximately once each year is considered an appropriate tide height to base the design of protective works. Therefore, the design tide elevation is 12.6 feet above Mean Low Water or 3.1 feet above Mean High Water, see Table B-1, Appendix B.

3. Design Wave. - The design wave used herein is that generated over the limited fetch and depth offshore from the study area with a wind velocity of 50 miles per hour (or 73.3 feet per second). The maximum fetch lies in a north-northeasterly direction from the study area to Pemberton Point, Hull. This distance is 20,000 feet. Because of limitations in the width of fetch the method described in Beach Erosion Board Technical Memorandum No. 70 "Effect of Fetch Width on Wave Generation" is used to compute the effectiveness of fetch in the study area. This calculation shows the effective fetch to be 50 percent of the measured distance, or 10,000 feet. Using Bretschneider's method as presented in TR-4 the computation for the design wave is as follows:

$$\frac{gF}{U^2} = \frac{32.2\ (10{,}000)}{(73.3)^2} = 60$$

$$\frac{gd_f}{U^2} = \frac{32.2\ (15.6)}{(73.3)^2} = 0.0936$$

$$\frac{f}{m} = \frac{0.01}{0.00165} = 6.0$$

Where g is the acceleration of gravity, F the effective fetch, U the wind speed, d_f the depth of water at the end of fetch at design tide level, f the friction factor in Bretschneider's formula for generation of wind waves in shallow water and m is the average slope of bottom along the fetch.

Using Figure 15 of TR-4:

$$\frac{gH_o^1}{U^2} = 0.019$$

Where H_o^1 is the equivalent deep water significant wave height.

$$H_o^1 = \frac{0.019\ (73.3)^2}{32.2} = 3.2$$

Using the solitary wave formula:

$$d_b = 1.28\ H_o = 1.28\ (3.2) = 4.1 \text{ feet}$$

Where d_b is the depth of breaking

Using Figure 7 of TR-4:

$T = 3.1$ seconds
$L_o = 5.12\ T^2 = 5.12\ (3.1)^2 = 49$ feet

Where T is the wave period and L_o is the deep water wave length.

From the above:

$$\frac{d}{L_o} = \frac{4.1}{49} = 0.0837$$

Using Table D-1 of TR-4:

$$\frac{H}{H_o 1} = 0.9497$$

Where $\frac{H}{H_o 1}$ is the shoaling coefficient.

Therefore, the computed wave is:

$H = 0.9497\ (3.2) = 3.0$ feet.

Refraction effects, using the graphic method described in TR-4, may be estimated to result in a wave reduced to two thirds of its original height. However, application of the wave theory to the peculiar physiography of the Wessagussett locale to forecast probable wave characteristics can be expected to yield somewhat doubtful results and therefore the offshore wave height of 3 feet is used as the design wave.

4. Stone Sizes. - The minimum cover stone sizes required for groins and stone mounds in the area are estimated on the basis of methods presented in TR-4. A design wave of 3.0 feet would give a w/k^1 value of 4.4×10^4 for side slopes of 1 on 1.5 and specific gravity of stone of 2.60. The K^1 value for this slope is 0.0085 pounds. Therefore, the minimum weight w = 400 to 500 pounds. It would be desirable, however, to use stone of about 1 ton in weight if no additional cost is incurred.

APPENDIX E

TOWN PLAN OF DEVELOPMENT

The original plans of the Town of Weymouth for development of Wessagussett Beach are described in a report by the Wessagussett Beach Development Committee proposing a "Development Program, 1958-1959." This program includes five projects which consist of the following items.

Project #1. Beach Improvement. -

a. Construction of a concrete sea wall with top elevation 15.0 feet above Mean Low Water along the northerly side of Wessagussett Road, 40 feet north of the south property line of the Wessagussett Yacht Club property to a point adjacent to North Street where the present wall exists at elevation 15.0 feet above Mean Low Water. The length of the proposed wall is about 630 feet.

b. Construction of a jetty approximately 240 feet long along the easterly line of the Wessagussett Yacht Club property. This jetty would have a top width of 10 feet, a constant top elevation of 15.0 feet above Mean Low Water for the shoreward 110 feet and a top sloping from elevation 15.0 to 10.0 feet above Mean Low Water for the remaining seaward portion of the jetty.

c. Relocation of the present groin at North Street.

d. Placement of sandfill along about 1000 feet of shore with a berm about 70 feet wide ranging in elevation from 13.0 to 13.5 feet above Mean Low Water. The beach would have a slope of 1 on 10 above and a slope of 1 on 15 below Mean High Water.

e. Construction of a 24-inch (changed later to 42 inch) corrugated iron surface drain to extend to the end of the west jetty. This drain would substitute part and serve as an extension to the existing drain at Wessagussett Road about 150 feet east from the Yacht Club property line.

Project #2. Roadway Improvement. -

a. Concrete curb on the north and south side of Wessagussett Road between Massasoit Road and North Street and between Massasoit Road and Pilgrim Road.

b. Concrete walks along Wessagussett Road, 4 feet wide on the south side and 10 feet wide on the north side between Massasoit Road and North Street, and 5 feet wide on the south side between Massasoit Road and Pilgrim Road.

c. A 26-foot wide bituminous concrete roadway on Wessagussett Road between Massasoit Road and North Street and widening of the roadway between Massasoit Road and Pilgrim Road.

d. Removal of the existing retaining wall along Wessagussett Road between Massasoit Road and Pilgrim Road and construction of a new retaining wall about 10 feet south of the existing wall.

e. Three sets of removable wooden steps to be placed over the new seawall on the south side of Wessagussett Road.

f. Traffic control signals to be installed at three points along Wessagussett Road; at North Street; Massasoit Road and Parker Avenue.

Project #3. Parking Area and Enlargement and Improvement. -

a. Enlargement of the existing parking area by placement of fill.

b. Earth bituminous treatment of the parking area.

c. Two shelters for parking attendants.

Land Right Acquisition. -

a. Acquisition of land rights for Parker Avenue.

Project #4. Seawall and Stone Mound at Regatta Road. -

a. A stone mound from the present east wall of the bathhouse for a distance of about 1500 feet to Neck Street. The mound would have a top elevation of 18 feet above Mean Low Water, a seaward slope of 1 on 3 and a landward slope of 1 on 1. A short concrete apron at the toe of the mound. Revetment of the slope above the top of the stone mound to elevation 26 feet above Mean Low Water.

b. A similar stone mound and a pre-cast block seawall about 500 feet in length from Neck Street to the end of the present seawall along Fort Point Road.

Project #5. Dredging. -

a. Dredging in the vicinity of Wessagussett Yacht Club to a depth of 8 feet below Mean Low Water to provide additional mooring space. This would require dredging of an estimated volume of 18,500 cubic yards of material.

APPENDIX F

COST OF IMPROVEMENTS

1. General. - A useful life of 50 years has been assumed in determining amortization charges. A rate of interest of 2.5 percent per annum for Federal and 3.0 percent per annum for non-Federal investment has been used. Maintenance requirements of sandfills are based on maximum rates of loss determined from past shore recession. For the Regatta Road and River Street stone mound, excavation and backfill are required. All excavated material is used for backfill and the cost of this operation is included in the unit price for stone. The pre-authorization survey study cost of $8,000 has been allocated between the three sections of the study area in proportion to their respective shore lengths and amount of survey work involved. All costs are based on the December 1958 price level.

2. Wessagussett Road Section. - Sand Fill Plan. -

(a) First Cost of Construction:

Sandfill, 45,000 cubic yards @ $1.40	$63,000
Groin, 4,500 tons @ $4.00	18,000
42" drain extension, 490 feet @ $17.50	9,000
3 manholes, tide gate and navigation marker	3,000
Contingencies	16,000
	$109,000
Engineering and design	4,000
Supervision and administration	9,000
PROJECT TOTAL	$122,000
Pre-authorization study	3,000
TOTAL INVESTMENT	$125,000

(b) Annual Charges:

Interest and amortization:	
Federal (2⅜%, 50 yrs)	$1,500
Non-Federal (3%, 50 yrs)	3,200
Sandfill, 1,000 cubic yards @ $1.70	1,700
Groins, 50 tons @ $5.00	300
TOTAL	$6,700

3. Regatta Road and River Street Sections. - Sand Fill Plan. -

(a) First Cost of Construction

Sandfill, 140,000 cubic yards @ $1.40	$196,000
Stone mound, 2,000 tons @ $4.00	8,000
Groins, 4,000 tons @ $4.00	16,000
Contingencies	33,000
	$253,000
Engineering and design	8,000
Supervision and administration	20,000
PROJECT TOTAL	$281,000
Pre-authorization study	5,000
TOTAL INVESTMENT	$286,000

(b) Annual Charges

Interest and amortization:	
Federal (2½%, 50 yrs)	$ 3,400
Non-Federal (3%, 50 yrs)	7,400
Sandfill, 1,000 cubic yards @ $1.70	1,700
Stone mound and groins, 60 tons @ $5.00	300
TOTAL	$12,800

4. Regatta Road Section - Alternative - Stone Mound Plan. -

(a) First Cost of Construction

Stone mound, 6,000 tons @ $4.00	$24,000
Contingencies	4,000
	$28,000
Engineering and design	1,000
Supervision and administration	2,000
PROJECT TOTAL	$31,000
Pre-authorization study	4,000
TOTAL INVESTMENT	$35,000

(b) Annual Charges

Interest and amortization:	
Federal (2½%, 50 yrs)	$ 100
Non-Federal (3%, 50 yrs)	1,300
Stone mound, 60 tons @ $5.00	300
TOTAL	$1,700

5. River Street Section - Alternative - Stone Mound Plan. -

(a) First Cost of Construction

Stone mound, 2,000 tons @ $4.00	$ 8,000
Contingencies	1,000
	$ 9,000
Engineering and design	300
Supervision and administration	700
PROJECT TOTAL	$10,000
Pre-authorization study	1,000
TOTAL INVESTMENT	$11,000

(b) Annual Charges

Interest and amortization:	
Federal (2½%, 50 yrs)	$100
Non-Federal (3%, 50 yrs)	300
Stone mound, 20 tons @ $5.00	100
TOTAL	$500

APPENDIX G

ESTIMATE OF BENEFITS

1. General. - The benefits computed herein are based on the promotion and encouragement of healthful recreation of the people by protection and improvement of public beaches and prevention of direct damages to public and private property. The intangible benefit of increasing the desirability of the beach and, therefore, increasing pleasure obtained, therefrom, is not evaluated. All benefits evaluated are non-Federal public or private benefits. The methods used for computing benefits are described below.

2. Direct Damages Prevented. - The area is well sheltered from ocean waves, but is exposed to northeast storms across Hingham Bay. Tides and waves cause erosion and damages to the study area. Direct damages in the area consist of loss of land, and damages to roads, buildings and other structures. The average annual value of loss of land is estimated as 1/50 the present market value of land, which would be eroded at the present rate of erosion within the 50-year economic life of the project. Land values have been estimated on the basis of reported current real estate sales in the area. The annual damages to roads are estimated on the basis of reported expenditures by the Town of Weymouth for storm damage repairs. The annual damages to buildings are estimated as 1/50 their present market value if complete loss is contemplated within the economic life of the project, or as 1/50 the extent of destruction of a building if partial damage is estimated within that period. Where records of current expenditures for repairs of buildings are available, they are used as a basis for the estimate. Other structures, such as retaining walls, swimming pools, etc., are estimated to suffer annual damages equal to 1/50 their cost of construction if totally destroyed in a period of 50 years or 1/50 the cost of reconstruction of damaged portions. The average annual damages are also estimated on the basis of actual expenditures for storm damage repairs where such records are available.

3. Devaluation of adjacent properties and remaining portions of lots and buildings which would result from the estimated damages, during a 50-year period, is considered secondary and, therefore, is not evaluated.

4. Recreational Benefits. - Part of the study area is presently used as a town beach. This is the only public beach in Weymouth and is considerably overcrowded. Present annual attendance is estimated at about 70,000 persons. The Town has limited shoreline that could be developed for bathing purposes; the study area being one of the better areas. Other portions of the shore in Weymouth Fore River and Weymouth

Back River are devoted to industrial waterfront uses. Public recreational facilities in the study area, other than the bathing beach, include the Great Hill Park Reservation, which is maintained by the Town of Weymouth. Improvement of the study area for recreational beach use would be supported by a potential additional attendance of about 430,000 persons per season. Experience with available attendance records of public beaches in Connecticut shore towns has indicated that annual patronage amounts to at least 10 times the population. The present population of Weymouth is about 50,000 persons and the total potential attendance is estimated at 500,000 persons. In view of the density of population of other nearby towns and the proximity to the metropolitan area it is believed that the above potential attendance is conservative.

5. Recreational benefits from beach use are estimated on the basis of a desirable beach area of 75 square feet per person and a daily turnover of 2. Analysis of attendance records at Eastern Point Beach Park in Groton, Connecticut, a beach similar in character, shows that the average daily attendance for a 93-day season was 30 percent of the peak attendance and that the capacity was 36 percent of the peak. It is further indicated that the average daily attendance for the days less than capacity is about 36 percent of the space capacity. There are 35 days with attendance above capacity and 58 days below. The seasonal attendance is estimated at 28 times the peak and that portion which is within the desirable standards is estimated as 56 times the daily space capacity where the capacity is 36% of the peak. A similar pattern is assumed for the proposed beach plans in this study. The recreational value per person for beach use is evaluated as the minimum charge which patrons would be required to pay if the beach was a private enterprise. This is estimated as $0.25 per person.

6. In order that public recreational benefits may be realized, adequate parking and comfort facilities should be provided. Desirable parking space may be computed on the basis of 4 persons per car and a turnover of 2. Bathhouse facilities should be provided for about 10% of the beach users, on the basis of records available from Jones Beach, Jacob Riis Park and Orchard Beach in the New York area.

7. Wessagussett Road Section - Sandfill Plan. -

(a) Direct Damages Prevented. - Annual expenditures by the Town of Weymouth for repairs to the bathhouse, walls, sidewalks and placement of sand fill are reported to average about $3,000 annually, and repairs to Wessagussett Road are reported to average about $5,000. These expenditures reflect both costs due to storm damages and costs of normal maintenance of the facilities. The proposed improvements would reduce or eliminate storm damages only and would probably increase the wear of the road and bathhouse facilities due to the anticipated increase in use. The expenditure made annually for sand fill will be eliminated by the project and has been included in the estimate

of maintenance of the proposed improvements. Damage to the bathhouse and seawall will be reduced, and damage to Wessagussett Road will be eliminated with the proposed improvements at an estimated saving to the Town of Weymouth of about $4,000. The proposed improvements would further provide protection to the private property at the west end of the beach, seaward from Wessagussett Road and eliminate flooding and damage during extreme high tides of the private properties shoreward from Wessagussett Road. No figures are available on the extent of damages suffered at present by these properties. It is estimated, however, that they would amount to about $200, annually, if no protection is provided and that they would be completely eliminated with provision of the proposed protection.

(b) Recreational Benefits. - Widening of about 1000 feet of beach to 125, 175 and 35 feet in width will provide additional beach area of about 90,000 square feet. At desirable standards this area would have an additional daily capacity of 90,000x2/75 = 2,400 persons. The peak daily attendance would be 6,700 persons, and the gross annual attendance would be 6700 x 28 = 188,000 persons, exclusive of 70,000 persons, the present attendance. The seasonal attendance at desirable standards is estimated to be 2400 x 56 = 134,000 persons. The annual non-Federal public recreational benefit therefore is computed to be: 134,000 x $0.25 = $33,500. Since only limited parking facilities are available at present it is mandatory that adequate parking space be available in order to realize the above benefits.

(c) Summary of Benefits. -

Benefit	Public	Private	Total
Direct damages prevented	$4,000	$200	$4,200
Recreational	33,500	0	33,500
	$37,500	$200	$37,700

8. Regatta Road and River Street Sections - Sand Fill Plan. -

(a) Direct Damages Prevented. -

(i) Regatta Road Section. - Erosion of the bluff in this area due to storm waves and tidal currents results in loss of a strip of town property along the beach and endangers private property on the bluff. If no attempt is made to curb erosion in this area and the present rate of recession of the shoreline of 0.5 foot per year is permitted to continue, the strip of town property will completely disappear and the back yards of the private properties on the bluff will be seriously damaged or destroyed within the economic life of the project. Protective measures will result in preservation of the town and private properties. The town property consists of about 2 acres of

shore and bluff face land which is relatively inaccessible and unuseable except as a protective zone for the private properties on the bluff. The value of this land is estimated at about $5,000 per acre or a total of about $10,000. Valuable private land on the bluff which would be destroyed if not protected amounts to about 1 acre valued at about $20,000. An additional benefit of about $20,000 would result from protection from damage to three outdoor swimming pools, a marine railway and boat platform, and to houses seaward from Regatta Road. These benefits are estimated to result from protection of this area over a period of 50 years. The average annual benefit, therefore, is estimated at 1/50 of the above, i.e. $200 for public land and $800 for private property.

(ii) River Street Section. - This area is low and unprotected. Six cottages seaward from River Street are already considerably damaged by waves and tides and most of the land has been eroded. These properties are estimated to have a total value of about $15,000. Unless protection is provided here these cottages would eventually be completely destroyed and the land eroded. However, since this plan requires public ownership and clearance of these properties, no benefits would result. River Street which presently suffers damages from storms will be subject to even greater damage in the future as the shore erodes. Present expenditures on this road are reported as $3,000, of which it is assumed that about $2,000 is due to waves and tides. It is estimated that the benefit from reduction of damages to the road would amount to at least $2,000 after provision of protection.

(b) Recreational Benefits. - Construction of a beach about 125 feet wide and 1,600 feet long, along most of Regatta Road Section and along all of River Street Section, will provide beach area of about 200,000 square feet. This area would have a daily capacity at desirable standards of 200,000 x 2/75 = 5300 persons. Such a beach would have capabilities for a peak attendance of 14,700 persons and a seasonal attendance of 412,000 persons. However, since 258,000 persons of the 500,000 town potential are estimated for the present and prospective attendance at the Wessagussett Road Section, the maximum possible attendance at the Regatta Road and River Street Sections is 500,000 - 258,000 = 242,000 persons. The daily peak for this attendance is estimated to be 242,000/28 = 8,600 persons. The capacity is thus 62 percent of the peak. Using the attendance distribution at Eastern Point Beach Park, Groton, Connecticut, for this relation of capacity to peak, the seasonal attendance at desirable standards is 43 times the capacity. The seasonal attendance within desirable standards is estimated to be 5300 x 43 = 228,000 persons. The annual non-Federal public recreational benefit, therefore, is computed to be 228,000 x $0.25 = $57,000. Since no facilities are available and access to the beach is relatively difficult at present it is mandatory that facilities be provided in order to realize the above estimated recreational benefits. In addition the

cottages seaward from River Street should be cleared unless incorporated in the bathhouse facilities. To facilitate access to the portion of the beach in the Regatta Road Section a suitable public walkway or boardwalk should be provided along the bottom of the bluff and a suitable public stairway from Regatta Road to the beach at about the center of the bluff.

(c) Summary of Benefits:

Benefit	Public	Private	Total
Direct damages prevented	$2,200	$800	$3,000
Recreational	$57,000	$0	$57,000
	$59,200	$800	$60,000

9. Regatta Road Section - Alternative - Stone Mound Plan. - This plan would result in benefits from prevention of direct damages as were discussed in the previous paragraph. These benefits consist of $200 public and $800 private benefits, or a total of $1,000 in annual benefits.

10. River Street Section - Alternative - Stone Mound Plan. - Direct damages in this area were discussed in paragraph 8 of this appendix. Since this plan would protect the private cottages seaward of River Street, there would be a private benefit of $300, annually, over a period of 50 years, in addition to the public benefit of $2,000 from protection of River Street. The total annual benefits for this plan, therefore, are estimated at $2,300.

CORPS OF ENGINEERS

U. S. ARMY

HIGH WATER SHORELINES
6' DEPTH CURVES

12' DEPTH CURVES

18' DEPTH CURVES

24' DEPTH CURVES

VICINITY MAP
SCALE IN FEET
2000 0 2000

LOCATION MAP
SCALE IN MILES

SHORELINE AND OFFSHORE DEPTH CHANGES
SCALE IN FEET
1000 0 1000 2000 3000

LEGEND

HIGH WATER SHORELINE
1847 ——o——o—— U.S.C.&G.S.
1948 ——————— U.S.C.&G.S.
1958 - - - - - - - TOWN OF WEYMOUTH

DEPTH CURVES

	6 FT.	12 FT.	18 FT.	24 FT.	
1846-1848	—x—	—xx—	—xxx—	—xxxx—	U.S.C.&G.S.
1863	—o—	—oo—	—ooo—	—oooo—	U.S.COMMISSIONER'S REPORT
1893	—•—	—••	—•••	—••••	U.S.C.&G.S.
1952	—I—	—II—	—III—	—IIII—	U.S.C.&G.S.
1958	- - - -	- - - - -	- - - - -	- - - - -	TOWN OF WEYMOUTH

WESSAGUSSETT BEACH

WESSAGUSSETT RD. SECTION

REGATTA RD. SECTION

RIVER ST. SECTION

Profile 1 · Profile 2 · Profile 3 · Profile 4 · Profile 5 · Profile 6 · Profile 7 · Profile 8 · Section 9A · Section 9B · Profile 9 · Profile 10

6" DRAIN

18" DRAIN

TOWN GROIN

Stairs

BATHHOUSE

Marine Railway

Boat Platform

Top of bluff

Town of Weymouth Right of way

POOL

GREAT HILL DRIVE

REGATTA ROAD

BAYLEE RD.

NORTH ST.

PARKER RD.

MASSASOIT RD.

PILGRIM RD.

SQUANTO RD.

WESSAGUSSETT YACHT CLUB

GREAT HILL PARK

NORTH WEYMOUTH

FORT PT. SEAWALL

MARSH

(Owned by Town of Weymouth)

BROADMERE WAY

HECK ST.

WEYMOUTH BACK RIVER

RIVER ST.

NOTES:

General Map from survey of June 24, 1958, aerial photographs of February 3, 1958 and other maps furnished by the Town of Weymouth.

Shore lines are Mean High Water which is 9.5 feet above Mean Low Water.

Property lines are shown thus ——— • ———

Plane coordinates are on the Lambert Grid System for the Commonwealth of Massachusetts.

On wind rose, wind duration is given in percent per degree of direction. To obtain percentage of duration on basis of 8 points of the compass multiply given percentage by 45, for one of 16 points of compass multiply by 22.5.

WIND ROSE
BOSTON, MASS.
OCTOBER 1949 - SEPTEMBER 1958
BASED ON HOURLY OBSERVATIONS BY U.S. WEATHER BUREAU, LOGAN INTERNATIONAL AIRPORT

LEGEND
WINDS 32 MILES PER HOUR AND OVER IN HOURS PER YEAR
32-38 M.P.H.
39-46 M.P.H.
47 M.P.H. AND OVER

LEGEND (All Winds)
WIND SPEED (M.P.H.)
DURATION (% Per Degree)

COOPERATIVE BEACH EROSION CONTROL STUDY OF WESSAGUSSETT BEACH, WEYMOUTH, MASS.

GENERAL MAP AND SHORELINE AND OFFSHORE DEPTH CHANGES

IN 1 SHEET — SCALE IN FEET 200 100 0 100 200

NEW ENGLAND DIVISION, WALTHAM, MASS. APRIL 1959

APPROVED: Chief, Engineering Division

APPROVED: Col. C.E. Deputy Division Engineer

SUBMITTED: Chief, Planning and Reports Branch

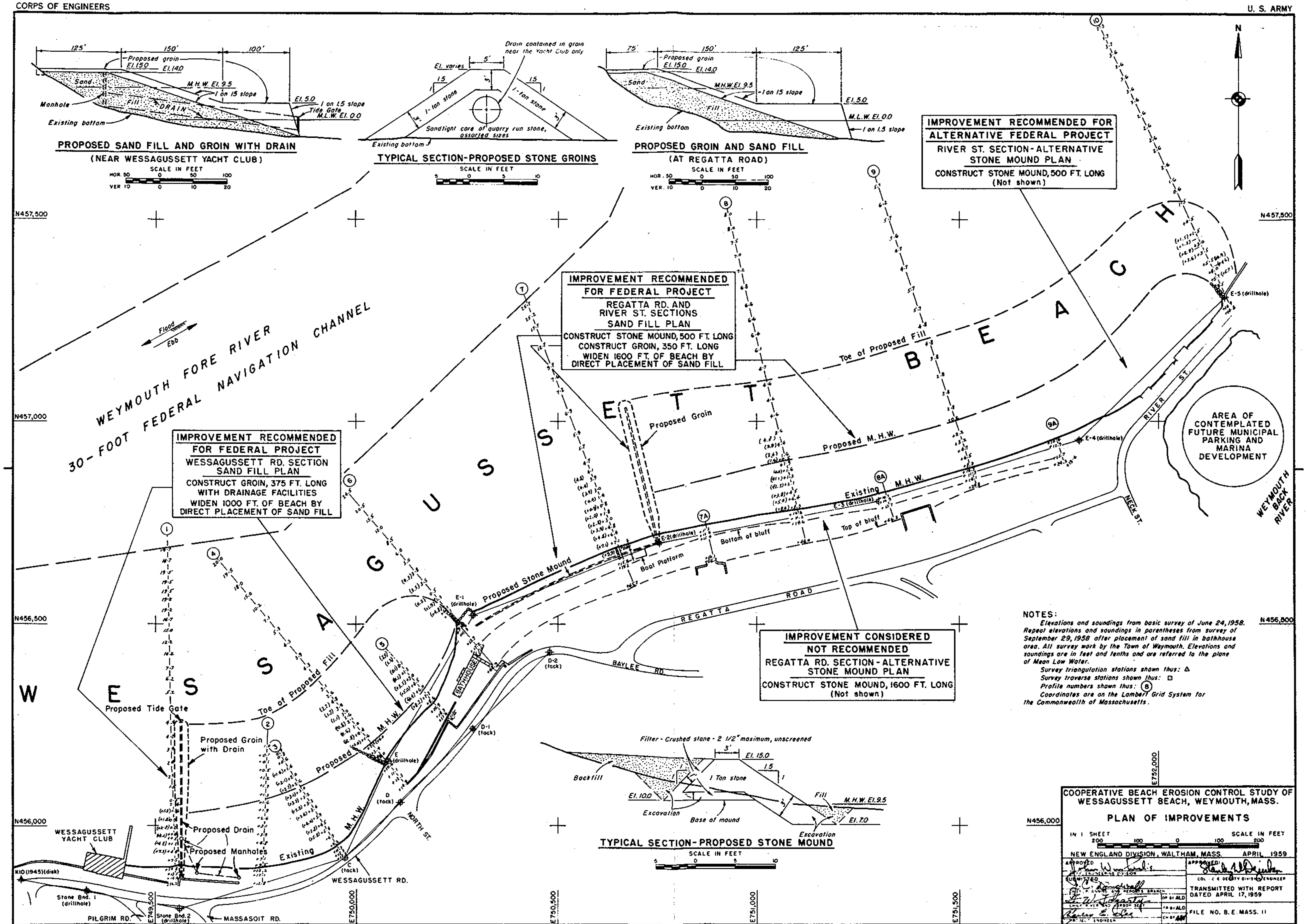
Chief, River and Harbor Sec. — DR by ALD — TP by ALD

Project Engineer — CH by

TRANSMITTED WITH REPORT DATED APRIL 17, 1959

FILE NO. B.E. Mass. 10

PLATE 1


PROPOSED SAND FILL AND GROIN WITH DRAIN
(NEAR WESSAGUSSETT YACHT CLUB)
125' 150' 100'
Proposed groin
El. 15.0 El. 14.0
M.H.W. El. 9.5
1 on 15 slope
El. 5.0
1 on 1.5 slope
Tide Gate
M.L.W. El. 0.0
Sand
Fill
DRAIN
Manhole
Existing bottom
SCALE IN FEET
HOR. 50 0 50 100
VER. 10 0 10 20
TYPICAL SECTION-PROPOSED STONE GROINS
Drain contained in groin near the Yacht Club only
El. varies
5'
1-ton stone
Sandtight core of quarry run stone, assorted sizes
Existing bottom
SCALE IN FEET
5 0 5 10
PROPOSED GROIN AND SAND FILL
(AT REGATTA ROAD)
75' 150' 125'
Proposed groin
El. 15.0 El. 14.0
M.H.W. El. 9.5
1 on 15 slope
El. 5.0
M.L.W. El. 0.0
1 on 1.5 slope
Sand
Fill
Existing bottom
SCALE IN FEET
HOR. 50 0 50 100
VER. 10 0 10 20
IMPROVEMENT RECOMMENDED FOR ALTERNATIVE FEDERAL PROJECT
RIVER ST. SECTION-ALTERNATIVE STONE MOUND PLAN
CONSTRUCT STONE MOUND, 500 FT. LONG (Not shown)
N
WEYMOUTH FORE RIVER
30-FOOT FEDERAL NAVIGATION CHANNEL
Flood
Ebb
IMPROVEMENT RECOMMENDED FOR FEDERAL PROJECT
REGATTA RD. AND RIVER ST. SECTIONS SAND FILL PLAN
CONSTRUCT STONE MOUND, 500 FT. LONG
CONSTRUCT GROIN, 350 FT. LONG
WIDEN 1600 FT. OF BEACH BY DIRECT PLACEMENT OF SAND FILL
IMPROVEMENT RECOMMENDED FOR FEDERAL PROJECT
WESSAGUSSETT RD. SECTION SAND FILL PLAN
CONSTRUCT GROIN, 375 FT. LONG WITH DRAINAGE FACILITIES
WIDEN 1000 FT. OF BEACH BY DIRECT PLACEMENT OF SAND FILL
W E S S A G U S S E T T B E A C H
Toe of Proposed Fill
Proposed M.H.W.
Existing M.H.W.
Proposed Groin
Proposed Stone Mound
Boat Platform
Bottom of bluff
Top of bluff
Proposed Tide Gate
Proposed Groin with Drain
Proposed Drain
Proposed Manholes
WESSAGUSSETT YACHT CLUB
BATHHOUSE
E-1 (drillhole)
E-2 (drillhole)
E-3 (drillhole)
E-4 (drillhole)
E-5 (drillhole)
E (drillhole)
C (tack)
D (tack)
D-1 (tack)
D-2 (tack)
K10 (1945) (disk)
Stone Bnd. 1 (drillhole)
Stone Bnd. 2 (drillhole)
PILGRIM RD.
MASSASOIT RD.
WESSAGUSSETT RD.
NORTH ST.
BAYLEE RD.
REGATTA ROAD
RIVER ST.
NECK ST.
AREA OF CONTEMPLATED FUTURE MUNICIPAL PARKING AND MARINA DEVELOPMENT
WEYMOUTH BACK RIVER
IMPROVEMENT CONSIDERED NOT RECOMMENDED
REGATTA RD. SECTION-ALTERNATIVE STONE MOUND PLAN
CONSTRUCT STONE MOUND, 1600 FT. LONG (Not shown)
NOTES:
Elevations and soundings from basic survey of June 24, 1958. Repeat elevations and soundings in parentheses from survey of September 29, 1958 after placement of sand fill in bathhouse area. All survey work by the Town of Weymouth. Elevations and soundings are in feet and tenths and are referred to the plane of Mean Low Water.
Survey triangulation stations shown thus: △
Survey traverse stations shown thus: ◻
Profile numbers shown thus: (8)
Coordinates are on the Lambert Grid System for the Commonwealth of Massachusetts.
TYPICAL SECTION-PROPOSED STONE MOUND
Filter - Crushed stone - 2 1/2" maximum, unscreened
3'
El. 15.0
1 Ton stone
Backfill
El. 10.0
Excavation
Base of mound
Fill
M.H.W. El. 9.5
El. 7.0
Excavation
SCALE IN FEET
5 0 5 10
N457,500
N457,000
N456,500
N456,000
E749,500
E750,000
E750,500
E751,000
E751,500
E752,000
COOPERATIVE BEACH EROSION CONTROL STUDY OF WESSAGUSSETT BEACH, WEYMOUTH, MASS.
PLAN OF IMPROVEMENTS
IN 1 SHEET
SCALE IN FEET
200 100 0 100 200
NEW ENGLAND DIVISION, WALTHAM, MASS. APRIL 1959
APPROVED
SUBMITTED
TRANSMITTED WITH REPORT DATED APRIL 17, 1959
FILE NO. B.E. MASS. 11

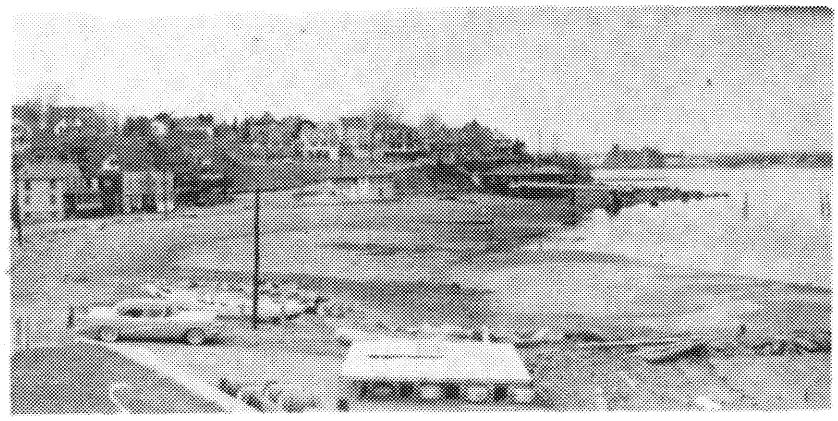


FIG. 1. Beach along Wessagussett Road near the Wessagussett Yacht Club at the west end of the study area. (March 25, 1958)

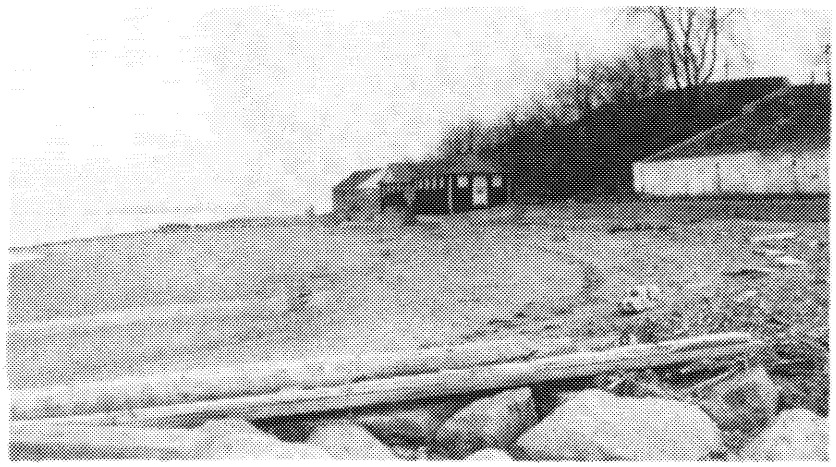


FIG. 2. Existing public beach in front of the Wessagussett Beach bathhouse. (March 25, 1958)

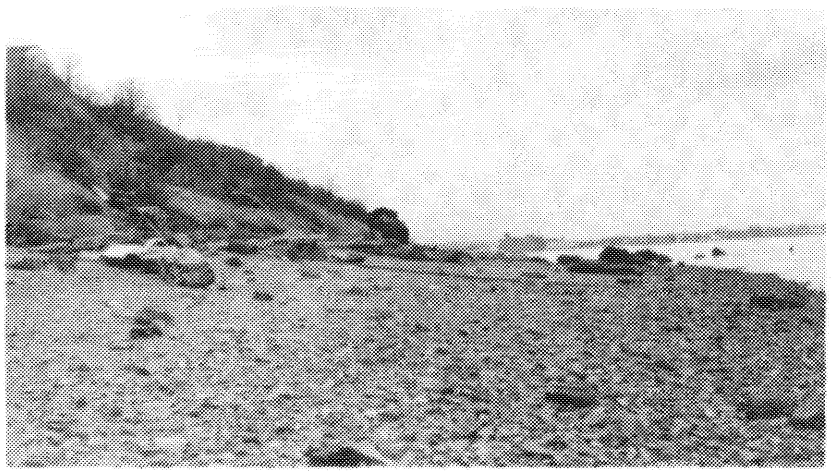


FIG. 3. Westerly half of bluff along Regatta Road. (March 25, 1958)

FIG. 4. Easterly half of bluff along Regatta Road (March 25, 1958)

FIG. 5. Beach and cottages along River Street at the east end of the study area. (March 25, 1958)

FIG. 6. Fort Point precast concrete seawall, extending to the east of the study area.(March 25, 1958)